An Evaluation of Quantity Surveying Software Usage in Northern Ireland

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AN EVALUATION OF QUANTITY SURVEYING SOFTWARE USAGE IN NORTHERN IRELAND

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Abstract

The majority of the duties performed by the Quantity Surveyor involve calculations and quantification which to a great extent lend themselves to computerisation. Today, there are many commercially developed software packages targeted at aiding the performance of quantity surveying duties. Whilst some QS firms have embraced the use of some of the software, it is common knowledge that some firms are yet to embrace them. Using structured questionnaire survey, this study attempts to evaluate the extent of usage of different modules of some selected QS software. In addition, it also attempts to assess the attractive factors for adopting the use of the selected software as well as the negative factors inhibiting their use. Using mean ranking analysis, the study concludes that the extent to which the private QS and the contractor's QS use dedicated software varies depending on the purpose for their use. The major attractive factors for adopting the use of QS software are the speed of use as well as enhanced quality of document production. The major negative factors inhibiting the adoption of QS software are lack of computer literacy as well as unwillingness to acquire software due to high initial cost, which may be unaffordable by the very small firms as well as the cost of training.

Keywords: attractive factors, mean ranking, negative factors, quantity surveying, software

INTRODUCTION

The quantity surveying profession has experienced significant changes over the past decade in terms of scope and type of services provided within and outside the construction sector (Smith, 2003). The changing role of the quantity surveyor has come about due to the demands of both the construction industry and the construction client. The changing role of the quantity surveyor includes, fast track procurement which necessitates faster bills of quantities production as well as cost planning; value management, risk management, commercial management, etc (Cartlidge, 2006). Some of such changes have been possible due to the introduction of Information Technology (IT). According to Long and Long (1997), IT by definition is a collective reference to the integration of computing technology and information processing. As pointed out by Cartlidge (2006) quantity surveyors have been greatly impacted by the information technology revolution, the speed and development of which has been breathtaking. This is not surprising because the majority of the duties performed by the

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Quantity Surveyor involve calculations and quantification which to a great extent lend themselves to computerisation.

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Amor *et al*, (2002) however pointed to the fact that some fundamental issues relating to IT applications in the construction sector of the economy have not been fully addressed, for example what types and sizes of businesses have used IT, what types of IT have been used and what are their functions, what hardware and software are used, how successful IT has been implemented, what are the main benefits and difficulties encountered. Today, there are many commercially developed software packages targeted at aiding the performance of quantity surveying (QS) duties. Whilst some QS firms have embraced the use of some of the software, it is common knowledge that some firms are yet to embrace them. This study therefore attempts to evaluate the extent of usage of different modules of some selected QS software. It also attempts to assess the attractive factors for adopting the use of the selected software as well as the negative factors inhibiting their use.

AN OVERVIEW OF SOFTWARE USAGE IN THE CONSTRUCTION SECTOR

According to Sun and Howard (2004) and Marsh and Flanagan (2000), the construction industry has for many years been a leading sector in design and engineering. According to them, today's construction industry is perceived as a world leader in relation to innovation and problem solving. However, although the construction industry's position is strong in relation to the issues mentioned above, when compared with other industries, the adoption and usage of IT has been somewhat lacking. (Sun and Howard 2004).

Marsh and Flanagan (2000) point out that the construction industry is lagging behind other industries in relation to the up-take of IT and support this statement quoting both the Latham (1994) and Egan (1998) reports. This view is echoed in research undertaken by Peansupap and Walker (2005) who argue that the reasons behind this slow adoption are a range of factors including ICT immaturity levels and financial constraints. Under-investment in IT developments by firms has also been cited as a reason for this slow uptake (Sarshar *et al,* 2000). Construction companies are still perceived as having a reliance on personal contact and paper based systems to manage information in the supply chain (Amor *et al,* 2002). Complexities within the construction supply chain and disparate information formats have also caused difficulties in adoption of it. At the same time many construction firms have taken advantage of advances in IT for managing payroll and invoicing (Marsh and Flanagan, 2000).

Although the above research does point to a lower rate of IT adoption, there is evidence to suggest that the rate of adoption is increasing. Sun and Howard (2004) have noted that the steady increase of computer ownership and IT applications have been supported by surveys carried out by professional

bodies, such as the RIBA, CICA, and RICS. A survey conducted in 1999, by the Building Centre Trust (cited in Marsh and Flanagan, 2000) into the use of I.T. in construction, identified 80 projects in which 403 professionals were interviewed. The published findings noted that, larger organisations invest more in IT compared with smaller organisations. The findings also unearthed a prevalent attitude of resistance to early adoption of I.T – firms were more willing to wait for I.T. applications with a proven track record. 86% of professional surveyed had access to a computer, with 97% having email access and 88% having access to the internet. However only 13% had ever placed an order online with a supplier indicating that e-commerce is still to be adopted. Only 15% of projects have implemented a dedicated IT project strategy.

Marsh and Flanagan (2000) also noted that more and more software packages are becoming available for various tasks such as project cost control analysis and cost control. This statement is supported by Bedard (2003) when he stated that one way to characterize the recent advances in IT in many fields including construction is the progression from isolated very specialized applications to environments capable of communicating with others, performing several tasks and encompassing different concerns. However, the increase in computer usage as highlighted by these authors needs to be complemented with frameworks to increase IT usage. A recent study of the International Council for Research and Innovation in Building Research has outlined this as a major theme. Academic research in this area is now focusing on understanding the barriers to IT / software currently prevalent within the industry and the need to implement frameworks to remove these barriers (Peansupap and Walker 2005).

Software in the Quantity Surveying Profession

Cartlidge (2006) observed that some core aspects of QS duties such as measurement and information management have a great potential to benefit from the information technology revolution. Smith (2003) was however more drastic in his observation. According to him, it is inevitable that documentation and data will be increasingly automated to the point where measurement and other technical processes will require minimal human intervention.

According to Cartlidge (2006), the data and information management aspect of the QS duties makes it amenable to employ some general purpose software such as Excel spreadsheet. According to Pemberton and Robson (2000) for the majority of finance based planning and operations procedures, the spreadsheet is by far the most popular application. Shen *et al.* (2003) were of the opinion that Excel as part of the Microsoft suite is not designed for estimating, however it can be cleverly adapted using the spreadsheet functions for estimating. An in - house designed template is often used and changed for different jobs. According to Shen *et al.* (2003), this is an inexpensive way of estimating; however this is offset by the fact that it is time consuming, tedious and can get confusing for large

jobs. Shen *et al.* (2003) also reported cases where the Excel spreadsheet has been adapted for use in Bills of Quantities (BOQ) production. According to Sun and Howard (2004), the data and information management aspect of the QS duties makes it amenable to employ some general purpose software such as Microsoft access which is a database management software. Other general purpose softwares employed by the QS professionals include Microsoft Word and Microsoft PowerPoint (Sun and Howard, 2004).

According to Bedard (2003) one way to characterize the recent advances of IT in many fields including construction, is the progression from isolated very specialized applications to environments capable of communicating with others. This progression from IT to Information Communication Technology (ICT) has been a major attraction for many QS professionals embracing IT usage. According to Sun and Howard (2004), some ICT general purpose software employed by the QS professionals include: Internet facility (Internet Explorer or Netscape) and E-mail facility (Microsoft Outlook, yahoo, hotmail, etc.).

According to Cartlidge (2006) the speed of development of dedicated QS software has been breathtaking. A cursory look at the websites of most QS software providers shows that the modules incorporated in each software focus on core QS functions such as measurement, feasibility estimates, cost planning, measured estimates, cost management, e-tendering, project controls, cash flow, price book maintenance, resource analysis and whole life costs. Doherty (2007) provided a review of the major commercially available QS software in the UK construction sector. These include: the CATO Enterprise Suite, Masterbill Elite, Build Soft, Conquest, Valesco Estimating and RIPAC Estimating. According to Doherty (2007), some of the softwares are more suited to the contractor's QS whilst some are more suited to the Private QS (PQS).

Attractive Factors for Adopting QS Software and Negative Factors Inhibiting QS Software Usage

According to Shen *et al*. (2003), some attractive factors for adopting QS software include: reduced cost of document production, increased speed of production, reduction in time spent in document production and accuracy of processed information. According to Shen *et al*. (2003), by adopting an e - business application prior to the commencement of a project, the QS can save by not incurring consumables cost in relation to printing, but also radically streamline the amount of time spent on measurement. According to Smith (2003) the most obvious benefit for quantity surveyors lies in the use of automated quantities with the possibility of enormous productivity gains. Smith (2003) further substantiated this by pointing out that the preparation of quantities in the traditional based mode is tedious and time consuming and typically accounts for 80% of the total time spent in preparing tenders, budgetary estimates and cost plans. According to Smith (2003), removing much of the

technical drudgery through the use of computer software practitioners will be provided with more time to develop sophisticated, more accurate and reliable cost management systems. According to Tse and Wong (2004), the automated approach was found to be 14.3 times faster than the manual approach. This highlights the potential that software systems possess and the benefits that could be associated. Commenting on the accuracy and speed to which take off can be performed; Tse and Wong (2004) stated that in accuracy, digitizers replace the scale rule and computers perform the calculations.

According to Cartlidge (2006), some negative factors inhibiting QS software usage include: lack of knowledge and training, business size and maturity; and initial cost of hardware and software acquisition. Cartlidge (2006) emphasises the fact that lack of knowledge of new technologies on the part of senior surveyors, the people who set the business objectives, led to scenarios where investment in new technology is driven from the bottom up which may meet with resistance in some cases. Oyediran and Odusami (2005) carried out a study into the computer usage by quantity surveyors and found that there was a missing link in educational training where graduates were not given training in QS software usage before graduating. According to Castle (2006), it is imperative before implementing a specific type of software that an organisation first assesses its maturity and direction in which it wants business to progress. When this is done, then no longer will software adoption be seen as a burden or a grey area. Shen *et al.* (2003) identifies initial cost of hardware and software as one of the obstacles inhibiting IT implementation. Although they argue the fact that high installation costs of certain pieces of software are the key issue, Smith (2003) takes the view that it is due to the fact that many firms lack motivation to embark down this path due to the focus on short term profits.

DATA AND METHODOLOGY

Data for the study was obtained through a questionnaire survey of quantity surveyors working in the Northern Ireland construction sector. In order to achieve the most balanced results, stratified random sampling technique was employed whereby the surveyed QSs were sub divided into four main strata of private quantity surveyors, contractor's quantity surveyors, developer's quantity surveyors and quantity surveyors working within government departments. Confidential postal questionnaire survey was employed so as to facilitate access to a larger sample size which would therefore be more representative of the population. A total of 100 questionnaires were distributed. From this distribution, a total of 33 responses were received, representing a 33% response rate. This is slightly higher than the norm of 20-30% response rate in most postal questionnaire surveys of the construction industry (Akintoye and Fitzgerald 2000). Table 1 shows the responses from the various sectors.

Table1: Responses to questionnaire survey

Respondents' designation	Number of responses	Percentage of responses	Cumulative percentage
Private QS	16	48.48	48.48
Contractor's QS	11	33.33	81.82
Developer's QS	4	12.12	93.94
Government QS	2	6.06	100.00
total	33	100.00	

Due to the low level of response from the government/ public sector quantity surveyors, responses from this category were omitted from the analysis as they are statistically small. The questionnaire was drafted to best determine the type of software usage as currently employed by the Northern Irish quantity surveying profession and gauge those factors perceived as attractive in the adoption of software usage and those factors perceived as inhibiting software usage. These issues were investigated using the framework of a Likert-type scale, in which respondents were asked to rank their opinions from 1 – 5 (with 1 having the lowest rank and 5 the highest). Responses to the various questions were analyzed using the mean analysis. This use of the mean analysis allowed answers to be ranked in order to determine the relative importance of factors considered. The mean score is determined as follows:

$$\text{Mean Score} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{(n_5 + n_4 + n_3 + n_2 + n_1)} \qquad \text{(Equation 1)}$$

where n_1, n_2, n_3, n_4 *and* n_5 are the number of respondents who scored the responses as 1, 2, 3, 4 and 5 respectively.

DATA ANALYSIS AND RESULTS

Data analysis was carried out using the mean ranking analysis of responses to the questionnaire survey. The initial part of the analysis looks at the usage levels of general software (in this case the Microsoft Office suite of software) within the quantity surveying profession, the second part of the analysis examines the use of dedicated software within the quantity surveying profession. The third section examines the attractive factors for adoption of software and the final section deals with the factors that inhibit software usage.

General Software Employed in the Quantity Surveying Profession

The usage of general software within the Quantity Surveying profession was investigated by listing a number of the most commonly used office suite applications; in this case the most widely used programmes from the Microsoft Office suite. This selection was made due to the overwhelming popularity of the Microsoft suite- with over 90% of businesses worldwide using Microsoft's version of this software (Howard 2006). Respondents were asked to provide opinions regarding usage levels of the Microsoft Office suite on a Likert scale of 1 to 5, with 1 representing low level of usage and 5 representing very high level of usage. Table 2 shows the results of the mean response analysis.

Table 2: Usage levels of general office software in Quantity Surveying Establishments

MS Office Software	Overall	Rank	Private QS	Rank	Developer's QS	Rank	Contractor's QS	Rank
Excel	4.96	1	4.81	2	5.00	1	5.00	1
Outlook	4.62	2	4.88	1	4.00	4	5.00	1
Explorer	4.46	3	4.25	4	4.50	2	4.64	3
Word	4.24	4	4.31	3	4.25	3	4.18	4
PowerPoint	2.23	5	2.69	5	1.75	5	2.27	6
Access	1.83	6	1.63	6	1.50	6	2.36	5

Analysis of this data highlights the prevalence of usage of the Office suite in the QS industry, with 100% of respondents using the Microsoft package. This figure is not surprising, due to the dominance of these programmes in the workplace. Analysis of the mean ranking also shows a disparity in the usage of certain programmes within the suite. Core applications such as word processing (represented by Microsoft Word), spreadsheet creation (represented by Excel), E-mail access (represented by Microsoft Outlook) and Internet access (represented by Internet Explorer) score highly with all respondents, this is illustrated with high total mean scores, with all four applications returning mean values of 4.24 or higher on the Likert scale. This high level of usage is in contrast to low usage levels (and correspondingly low total mean rankings) of presentation software (represented by Microsoft PowerPoint) and database software (represented by Microsoft Access). The low level of usage of PowerPoint and Microsoft Access is not surprising. This is because most Quantity Surveyors are not involved in presentation, warranting the use of PowerPoint and many seem to be more comfortable with using the Excel for their database management rather than using Microsoft Access which is a more specialised application with lower availability. It is also worthy of note that Microsoft Access is only included in the 'professional' edition of the Microsoft office suite and thus potentially unavailable to many of the respondents.

Dedicated Software Employed in Quantity Surveying Practice

From the responses to the questionnaire survey, an analysis was carried out to determine the extent of overall usage of dedicated QS software in Northern Ireland construction sector. Table 3 details the result of the analysis.

Table 3: Respondents using specialist software

Respondents' Designation	Number of Respondents	Number of Respondents using specialist software	Percentage of Respondents using specialist software
Private QS	16	15	93.75
Contractors' QS	11	2	18.18
Developers' QS	4	4	100.00
Government QS	2	1	50.00
Total	33	22	66.67

From the analysis, given the limitation of the data available, it is evident that the majority (94%) of private Quantity Surveyors have embraced the use of QS dedicated software, whilst 100% of Developers' Quantity Surveyors have also embraced the use of dedicated QS software. This is expected as the two QS groups are representing the client interest who places a great premium on value for money. It is however a surprise that not many contractors QS (18%) are using QS dedicated software. This may be due to the fact that they take recourse to using the Microsoft Excel in performing most of their duties. It is however encouraging that overall 2 out of 3 Quantity Surveyors (67%) in Northern Ireland have now embraced the use of dedicated QS software

In a related study, Shen *et al.* (2003) and Smith (2003) have tried to benchmark the extent of QS software usage in China and Australia respectively. These studies have looked at some of the specialist software available in the market and the level of usage of modules within them. In this study, attempts were made to investigate the level of usage of six dedicated quantity surveying applications. These include the CATO Enterprise Suite, Masterbill Elite, Build Soft, Conquest, Valesco Estimating and RIPAC Estimating. These provide a spread of some of the most popular applications available to the QS profession in the UK today. From the survey analysis shown in Table 4 it is evident that CATO Enterprise suit of software is the most popular choice (64%) among the Northern Ireland Quantity Surveyors. This is followed by Buildsoft (27%) and Masterbill Elite (5%) as well as RIPAC Estimating (5%). It is evident from Table 4 that CATO Enterprise is most popular among the Private QS, possibly due to its inclusion of some modules which perform some QS functions which are not available in others.

Table 4: Usage of QS Dedicated Software

QS Dedicated Software	Private QS	Contractor's QS	Developer's QS	Gov't QS	Total	% of Total
CATO Enterprise	10	1	2	1	**14**	63.63
Masterbill Elite	1	0	0	0	**1**	4.55
Build Soft	3	1	2	0	**6**	27.27
Conquest	0	0	0	0	**0**	0.00
Valesco Estimating	0	0	0	0	**0**	0.00
RIPAC Estimating	1	0	0	0	**1**	4.55
Total	**15**	**2**	**4**	**1**	**22**	**100**

Since CATO was the only dedicated software package that had an adequate level of response allowing a statistically viable mean analysis to be carried out, the level of usage of the modules contained within the CATO Enterprise programme was evaluated on a Likert type scale ranging from 1 indicating not used at all and 5 indicating a very high level of usage. Table 5 shows the results of the mean response analysis.

Table 5: Usage Levels of Modules within the CATO Enterprise Suite

Function	Overall	Rank	Private QS	Rank	Contractor's QS	Rank
CATO procurement	3.70	1	4.40	1	3.00	1
Cost planning	2.68	2	2.70	2	2.67	3
Cost management	2.53	3	2.40	3	2.67	3
CAD measure	2.25	4	1.50	9	3.00	1
Drawing register	2.13	5	1.60	7	2.67	3
Quick Est	2.12	6	1.90	5	2.33	6
E-tendering	2.10	7	2.20	4	2.00	8
Project controls	1.87	8	1.40	10	2.33	6
Cash flow	1.73	9	1.80	6	1.67	9
Whole life costs	1.63	10	1.60	7	1.67	9

Responses from both the developer's quantity surveyors and government department quantity surveyors were so low that they would have been of no statistical value. As such, they have been excluded from this analysis. The levels of usage of the ten modules available in CATO software suite were investigated. From the analysis in Table 5, it is evident that CATO procurement ranked first overall with a mean score of 3.70. Under both the private and contractor's QS, this module also ranked 1st in level of usage. Cost planning ranked 2nd in the level of usage followed by cost management which ranked 3rd overall. From these results we can infer that CATO is used primarily as a tool to prepare bills of quantity and for cost estimation purposes. This corroborates the research carried out by Smith (2003) wherein those firms found to be using specialist application industry software were primarily using this software for estimating, cost planning and Bills of Quantities. This is not a

surprise as these are QS functions which involve quantification and thus lend themselves more to computerisation.

It is however interesting to note that whilst the use of CAD measure ranked 4th overall, it ranked 7th under the private QS (PQS) but 1st under the contractor's QS (CQS). This is a surprise as PQS are expected to find the use of CAD measure easier. This low ranking may however be due to non availability of CAD drawings for their use which is the basis for the use of CAD measure. On the other hand, where contractors produced drawings by themselves in a design and build procurement option, it is easier also for them to use CAD measure for measurement. It is also noteworthy that whilst 'E-tendering' module ranked 7th overall, it ranked 4th under the PQS whilst it ranked 8th under the contractor's QS. This suggests that the PQS are beginning to appreciate the benefit of paperless tendering as it saves them cost and time. Another interesting contrast in the survey analysis result is regarding the 'Project control' module. Whilst this module ranked 8th overall, it ranked 10th under the PQS whilst it ranked 6th under the contractor's QS. This is not a surprise because contractors are more concerned with project planning and control. As such, it is not a surprise that this module raked higher under their usage compared to the PQS. This contrast is also observable under the 'cash flow' and 'life cycle costs modules where their usage ranked higher under the PQS (rank of 6 and 7 respectively) compared to the contractor's QS where they both ranked 9th.

The analysis generally showed that the majority of Northern Ireland QS use the CATO Enterprise software with very few using other range of QS dedicated software. The analysis showed that the PQS seems to have some preference for some modules in the CATO software as evidenced by their level of usage. In the same way, the contractor's QS seems to have preference for some other modules as well. This may explain why the CATO Enterprise suit is more popular as it seems to cater for both the needs of the PQS as well as the contractor's QS. A cursory look at the analysis result in Table 5 shows that very few modules even attain a usage level of 3 and above indicating medium to very high level of usage. This suggests that the maximum potential of the entire suit of the software is currently still not being exploited. This observation may not be unconnected with the fact that rather than taking the time to learn the various modules of the dedicated QS software, many surveyors would rather still take recourse to the use of Microsoft Excel to do the job for which dedicated software are more suited. This again may explain why Microsoft Excel has the highest usage among most QSs as shown in Table 2.

Attractive Factors for software usage

In order to gain an understanding of factors perceived as beneficial to the adoption of software, respondents were asked to give their opinion by scoring these various constructs on a Likert scale of 1 to 5. Table 6 shows the results of the analysis.

Table 6: Attractive Factors of Software usage within QS Establishments

Attractive factors/ benefits	Overall	Rank	Private QS	Rank	Developer's QS	Rank	Contractor's QS	Rank
Document presentation	4.35	1	3.88	4	4.18	2	5.00	1
Accuracy of info	4.24	2	3.94	3	4.27	1	4.50	2
Increased speed	4.21	3	4.13	1	4.00	3	4.50	2
Capacity for info storage	3.91	4	4.00	2	3.73	4	4.00	5
Flexibility of usage	3.90	5	3.75	6	3.45	6	4.50	2
Value for money	3.70	6	3.81	5	3.55	5	3.75	6
Usefulness for analytical purpose	3.48	7	3.75	6	3.45	6	3.25	7

From the analysis result in Table 6, it is evident that the 3 high ranking attractive factors are 'Document presentation', 'Accuracy of information' and 'Increased speed'. However, it is a surprise to note that whist 'document presentation' ranked 1st overall and under the contractor's QS, it however ranked 2nd and 4th under the developer's QS and the PQS respectively. This may be due to the fact that speed is more important to the QS who in the past would spend months preparing the BOQ and other documents. On the other hand, accuracy of information seems to be more important to the Developer's QS whose main motive is to make as much as possible profit form development opportunities. Differences of opinions are also observable regarding 'capacity for information storage'. Whilst this factor ranked 4th overall, it ranked 2nd under the PQS whilst it ranked 4th and 5th under the Developer's QS and contractor's QS respectively. It is not a surprise that the PQS placed a higher premium on 'capacity for information storage' than other categories of QSs because he is the one that keeps project data and information on behalf of the client. QSs irrespective of the establishment where they work seem to be unanimous in their scoring of 'value for money' and 'usefulness for analytical purpose' attractive factors for embracing software usage as opinions are not radically different.

Factors Inhibiting Software Usage

In order to identify the main root causes of factors that inhibit software usage, respondents were asked to provide opinion by scoring these factors on a Likert scale of 1 to 5 as before. Table 7 shows the results of the analysis.

From the result of the analysis in Table 7, it is evident that high ranking inhibiting factors include, 'lack of computer literacy', 'unwillingness to acquire' and 'unwillingness to train'. It is however a surprise that whilst 'lack of computer literacy' ranked 1st overall, and under contractor's QS, it however ranked 4th under the PQS as well as under the Developer's QS. This differences of opinion may be due to the fact that whilst some QS in PQS office are keen on learning and using QS software,

Table 7: Factors Inhibiting Software Usage

Inhibiting Factors	Overall	Rank	Private QS	Rank	Developer's QS	Rank	Contractor's QS	Rank
Lack of computer literacy	3.54	1	3.06	4	3.82	4	3.75	1
Unwillingness to acquire	3.43	2	3.44	1	3.36	7	3.50	2
Unwillingness to train	3.39	3	3.25	3	3.91	1	3.00	3
Smallness of org. size	3.26	4	2.88	6	3.91	1	3.00	3
Preference for Excel	3.22	5	3.38	2	3.55	5	2.75	5
Too expensive to justify	3.22	6	3.00	5	3.91	1	2.75	5
Difficulty in adapting to change	2.94	7	2.88	6	3.45	6	2.50	8
Security/accuracy fears	2.51	8	2.31	8	2.45	8	2.75	5

their organisation may be unwilling to acquire new software as they may have a substitute in MS Excel. Again as it is evident from the Developer's QS' scoring, 'unwillingness to train', 'smallness of organisation' and 'initial cost of acquisition' seem to have higher premiums placed on them. Moreover, whilst 'unwillingness to acquire' ranked 2nd overall, it however ranked 1st under PQS' scoring, whilst it ranked 2nd and 7th under contractor's QS and Developer's QS respectively. This is a surprise because Developer's QS seems to perceive QS software acquisition rather too expensive to justify its acquisition and possibly may be due to the smallness in the size of many of them. It is also interesting to note that whilst 'preference for Excel' ranked 5th overall, it however ranked 2nd under the PQS scoring, whilst it ranked 5th under the Developer's QS and contractor's QS' scoring. This again underscores the inhibition posed to software acquisition due to the alternative found in the use of MS Excel.

CONCLUSION

This study has attempted to investigate the level of usage of general and dedicated QS software within the Northern Ireland construction sector. It also examines the attractive factors promoting the use of the software as well as the negative factors inhibiting the usage. The study concludes that with regards to general software usage, the majority of respondents surveyed used most functions of the Microsoft Office suite to a very high extent, with Excel proving to be the most highly utilised software application. This finding agrees with the research carried out by Shen *et al*. (2003) and Smith (2003). Furthermore the study concludes that electronic communication within the quantity surveying profession is at a high level, this could be an indication of the communication levels between the project team.

Data analysed on the usage of dedicated software showed a high level of preference for CATO Enterprise suit of software, followed by Buildsoft, Masterbill and RIPAC estimating respectively. The

analysis showed that the PQS seems to have some preference for some modules in the CATO software as evidenced by their high level of usage. These include CATO Procurement, Cost planning, cost management and E-tendering. These are essential for pre contract services which are a strong area of services provided by the PQS. In the same way, the contractor's QS seems to have preference for some other modules as well. These include CATO procurement, Cost planning, Cost management, CAD measure and Project controls. These are also essential for the range of services provided by the contractor's QS. This may explain why the CATO Enterprise suit is more popular as it seems to cater for both the needs of the PQS as well as the contractor's QS. One of the main highlights of the research findings was the low usage of many modules in dedicated software applications. A direct relationship between the high usage of Microsoft Excel and the low adoption of dedicated software can be automatically identified. Here it can be seen that within the quantity surveying profession Excel was being used as a direct substitute for a dedicated software application.

The study further concluded that high ranking attractive factors for adopting QS software usage include 'Document presentation', 'Accuracy of information' and 'Increased speed'. It also concluded that the negative factors inhibiting the adoption of QS software usage in the Northern Ireland construction sector include, 'lack of computer literacy', 'unwillingness to acquire' and 'unwillingness to train'. Knowledge of the attractive and negative factors is very important in promoting QS software usage as well as to overcome barriers.

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